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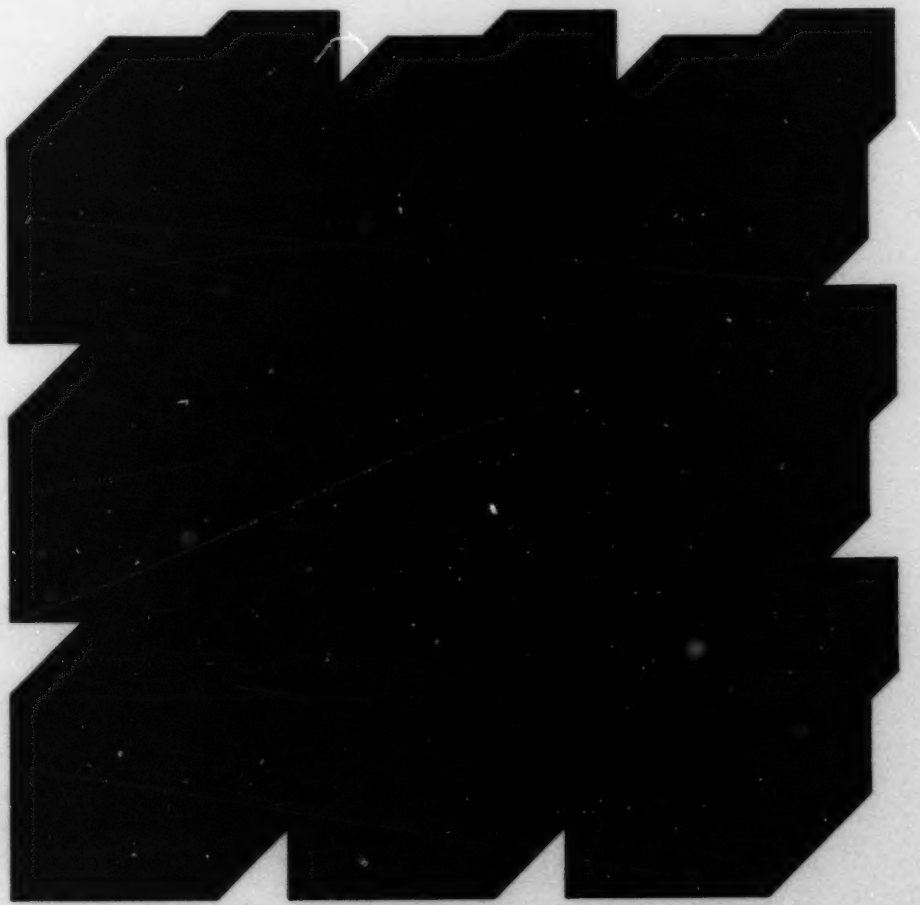

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DISCUSSION PAPER NO. 263

# Imports, Secondary Output, Price-Cost Margins and Measures of Concentration: Evidence for Canada, 1979

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**Résumé**

Les mesures de la concentration industrielle fondées sur les données du recensement sont largement utilisées pour montrer jusqu'à quel point un petit nombre d'entreprises peut contrôler une grande partie de la production d'une industrie. Ces mesures comportent toutefois un certain nombre de lacunes qui risquent éventuellement de devenir graves. Premièrement, la production entière d'une usine y est attribuée à une seule industrie, même si l'usine fabrique des produits imputés à d'autres industries (production secondaire). Deuxièmement, il n'est tenu aucun compte des importations, bien qu'elles créent une concurrence pour les entreprises canadiennes. Bien entendu, si elles se composent de produits très différents qui ne sont que des substituts bien imparfaits de ceux des entreprises canadiennes, il est peut-être normal de se fonder sur le recensement. Nous supposons toutefois, dans ce document, que les importations sont des substituts à nos produits canadiens ou, du moins, qu'ils sont tout aussi interchangeables que les divers types de produits d'une industrie donnée.

L'ajustement, au moyen des produits secondaires et des importations, des mesures de la concentration telles que publiées pour l'année 1979, nous porte à conclure que le secteur manufacturier canadien est plus compétitif que ne l'indiquent ces données. Le pourcentage de ses ventes, représenté par les quatre plus importantes entreprises parmi 140 industries à code de 4

chiffres de ce secteur, passe alors en moyenne de 52,6 à 42,7 %. L'ajustement par les importations explique la plus grande partie de cette différence. Par ailleurs, si l'on tient compte des exportations, en plus des importations et de la production secondaire, les résultats ne s'en trouvent guère modifiés. L'écart entre les mesures de la concentration publiées, d'une part, et celles corrigées pour tenir compte de la production secondaire et des importations, d'autre part, est beaucoup plus marqué dans le cas des industries d'envergure nationale que des industries régionales. La différence entre les ratios de la concentration tels que publiés et ceux obtenus par un ajustement en fonction du commerce a augmenté au cours des années 70.

Abstract

Census concentration measures are widely used as indicators of the degree to which a small number of firms control a large proportion of industry output. However, such measures suffer a number of potentially important shortcomings. First, all of the output of a plant is classified to a single industry, even though the plant may produce output classified to other industries (secondary output). Second, no account of imports is made even though they offer competition to domestic firms. Of course, if imports are highly differentiated products forming very imperfect substitutes for the output of domestic producers then the census approach may indeed by correct. However, in the paper we assume that imports and domestic production are substitutes, or at least no less substitutable than the various outputs of a given industry.

Adjusting published concentration measures for secondary output and imports for 1979 leads to the conclusion that Canada's manufacturing industries are more competitive than indicated by published data. The percentage of industry sales accounted for by the leading four firms, across 140 4-digit industries, on average, falls from 52.6 to 42.7. The import adjustment accounts for most of this difference. Adjusting the published measures of concentration to take into account exports, as well as imports and secondary output, does not substantially change these findings.

The differences between published concentration measures and those adjusted for secondary output and imports is much more dramatic for national than regional industries. Over the course of the 1970s the difference between published concentation ratios and those adjusted for trade has increased.

## I Introduction

Measures of concentration are widely used as indicators of market power, both in empirical studies of the determinants of inter-industry differences in performance (e.g., industry profitability, price-cost margins)[1] and in selecting mergers worthy of public scrutiny in Canadian[2] and U.S.[3] competition policy. The conventionally calculated concentration measures, published by statistical agencies in Canada and other countries, suffer from a number of well-known limitations -- all the output of a plant is classified to a single industry, even though the plant may produce output classified to several other industries (secondary output), and no account of imports is made.[4] This paper quantifies the importance of these limitations using 1979 Canadian data. It permits us to better assess the competitiveness of the Canadian manufacturing sector and to comment on U.S./Canadian differences in market structure. Finally, we use the corrected concentration ratios in an inter-industry performance study.

The paper is divided into four sections. In Section II, the size distribution of firms that is used to derive published concentration statistics is presented. Alternate firm size distributions, which correct published data for the limitations mentioned above, are discussed. In Section III the adjusted and unadjusted concentration statistics are compared and their use in studies of the determinants of inter-industry performance

examined. Finally, in Section IV, some conclusions are presented.

## II Adjusted and Unadjusted Firm Size Distributions

Concentration statistics are designed to capture the degree to which a small number of the largest firms dominate a particular market.[5] The greater the domination, it is frequently argued, the more likely it is that the leading firms will be able to act as a collusive oligopoly, limiting output, raising prices and realizing supra-normal returns. In contrast, in those markets where output is spread fairly equally amongst a large number of firms, it is argued the firm or small group of firms will be unable to elevate price above marginal cost, hence competitive conditions are likely to prevail.

Any measure of concentration depends upon: the market definition used; the sources of market supply considered; and the summary measure of firm size distribution that is adopted. The main contribution of this paper is to consider sources of supply -- and hence potential competition -- not normally considered by census concentration statistics.

The census authorities define markets by the use of the Standard Industrial Classification, which divides the manufacturing sector into a number of industries. This classification varies according to the level of aggregation selected. The level of classification

at which Canadian concentration statistics are published, the 1970 4-digit SIC, divides the manufacturing sector into 167 industries. (Canada. Statistics Canada, 1983). An industry is defined in terms of a set of primary or principal products. In some instances the industry is defined too broadly to approximate a market (e.g., Miscellaneous Metal Fabricating), while in others it is too narrow in that competing outputs are classified to different industries (e.g., wood and metal windows; glass and tin containers). For the purpose of this paper, we do not examine the adequacy of the Standard Industrial Classification, except indirectly.[6]

The Annual Census of Manufactures (census) limits itself to one source of supply in deriving industry output and size of firm: the sales of output of plants or establishments located in Canada. The output of each plant is decomposed into a series of products. All of the plant's output is classified to that industry whose primary product(s) account for the largest proportion of the plant's output: if 0.80 of the plant's output consists of products classified or primary to industry A and 0.20 to industry B, the census will classify all of the plant's output to industry A, including the secondary output in B. In this example, industry A's output is too large and B's too small. Furthermore, this method of approximating industry supply does not take into account offshore sources of supply (imports). In other words, the implicit assumption is made that imports and domestic production are highly imperfect substitutes. In including imports in

measuring concentration we are assuming that imports and domestic production are readily substituted for each other, or at least no less substitutable than the various outputs of a given industry.

A firm (or to use the census terminology in estimating concentration statistics, an unconsolidated enterprise) is defined as a collection of plants in an industry under common control. Hence by summing the output of all plants owned by a firm in a given industry, the size distribution of firms is generated. The proportion of industry sales accounted for by the ith firm will be referred to as Si, where there are N firms with at least one establishment classified to the industry.[7]

The first adjustment to the census or unadjusted size distribution of firms we make is to relax the assumption that all of the output of a plant or establishment should be classified to the primary industry of the establishment. The secondary output of the plant is allocated to the industry to which it is primary in building up the establishment's (and hence firm's) output profile. In the example cited above, 0.80 of the plant's output would be retained as belonging to industry A and 0.20 reclassified to industry B. More formally, the size distribution of firms if secondary output is allocated to its primary industry, is Ci, i = 1...M, where M is the number of firms with at least some output classified to the industry. Shipments or sales in this case refer to actual shipments of products primary to an industry, not an approximation, as in the case of Si. Typically M > N, for

a given industry, unless all of the plants classified to other industries have no secondary output of product classified to the given industry. More generally, if plants have no secondary output then Ci = Si and M = N. Since one of the purposes of the SIC system is to minimize the importance of secondary output, one would predict that while the differences between Si and Ci are difficult to specify a priori, the magnitude should be minimal. Across the 167 4-digit Canadian manufacturing industries for 1979, on average, primary output accounted for 90 per cent of the plants' output.[8]

The second adjustment made is for imports. Canada is a relatively open economy with imports accounting for 27.2 per cent of domestic disappearance in the manufacturing sector in 1979. (Economic Council of Canada, 1983, p. 114). This suggests that if imports are made by firms that do not produce domestically, the concentration of sales (including imports) will be lower than that for domestic production. However, recent studies suggest that a substantial proportion of imports are undertaken by Canadian manufacturers, particularly foreign owned, and that much of this is of an intra-corporate non-arms length nature (Canada. Statistics Canada, 1981 and Canada. Department of Industry, Trade and Commerce/Regional Economic Expansion, 1983). Hence in correcting the measurement of concentration, attention should be paid to the fact Canadian manufacturers import as well as produce goods in a given industry. A priori, it is difficult to specify

whether the two offsetting effects of adjusting for imports will affect the published concentration ratios.

In the course of conducting a study on characteristics of firms which import into Canada, Statistics Canada developed the facility to link the importing firm with its domestic Canadian operations (if there were any). As a result it is possible to estimate: Ti where i = 1...Q, with Q > M > N. Ti is the proportion of total imports plus domestic shipments (or sales) of products primary to a given industry, accounted for by the ith firm. Imports are classified to the "producer industry", defined as "the Canadian industry that would have produced a given commodity as a principal product." (Canada, Statistics Canada, 1981, p. XX). Because of this classification procedure, one can be reasonably sure that imports which are used as inputs to a given industry are not being classified as output of that industry and that imports are, depending upon the degree of product differentiation, competitive with domestic production.

The three firm size distributions, using Si, Ci and Ti, can be used to estimate the two measures of concentration published for the Canadian manufacturing sector. The first measure, the concentration ratio, (CR4), is defined as the proportion of industry sales accounted for by the largest R firms, where R in published data is 4, 8, 12, 16, 20 and 50. In this paper we confine our attention to R = 4, since this is the most frequently used form of the ratio. Using our earlier notation, we define,

$UCR4 = \sum_{i=1}^{4} Si$, $PPCR4 = \sum_{i=1}^{4} Ci$, and $SICR4 = \sum_{i=1}^{4} Ti$. The second measure of concentration, the Hirschman-Herfindahl Index, (HHI), is the sum of the squares of the industry shares of the individual firms. We define,

$$UHHI = \sum_{i=1}^{N} Si^2; \quad PPHHI = \sum_{i=1}^{M} Ci^2; \text{ and } SIHHI = \sum_{i=1}^{Q} Ti^2.$$

Both CR4 and HHI are widely used not only in Canada but also abroad as indicators of concentration. Both measures will lie between 0 and 1. The reciprocal of the HHI is known as the numbers equivalent - the number of equal sized firms required to generate a given value of HHI. CR4 only takes into account one point on the cumulative size distribution of firms, while the HHI index uses all of them. Theoretical underpinnings exist to demonstrate that the HHI and CR4 index should vary directly with a measure of performance. Further details may be found in Curry and George (1983, pp. 204-208). We are now in a position to calculate the influence these changes make on estimates of concentration.

## III The Results

The discussion in this section is divided into three parts. In the first part we consider how measured concentration, as published by census authorities, changes once adjustments are made for secondary output and imports. Second, we consider possible objections to the results presented here and make additional

adjustments to take into account these criticisms. In part these additional adjustments are made to facilitate comparison with earlier work for Canada, U.K. and U.S. Finally, we discuss the impact of adjustments to census concentration ratios on the relationship between concentration, imports and a measure of performance, the price-cost margin.

a) Measured Concentration and the Competitiveness of the Manufacturing Sector

CR4 and HHI have been used to classify industries as to their degree of competitiveness. In the case of CR4 a four fold classification system has been used: highly concentrated oligopoly (1.00-0.75); moderately concentrated oligopoly (0.50-0.749); slightly concentrated (or low grade) oligopoly (0.25-0.499); and atomism (0-0.249).[9] For HHI a three-fold division has been used by the U.S. Department of Justice in its recent merger guidelines: highly concentrated industries -- where competitive problems are likely to arise (0.1800-1.00); industries where "competitive concerns associated with concentration become significant to the point at which they become quite serious" (.1000-.1799); and markets which are likely to perform quite well (0.000-0.0999).[10] If all the firms in a given industry were of equal size, then the corresponding boundaries using the CR4 would be, approximately, 0.80-1.00; 0.40-0.80; and 0-0.40, respectively. The latter division, using the HHI index, would appear to reduce the cases

where performance is regarded as being adversely affected, and increases the scope for classifying markets as competitive.

Tables 1 and 2 present the distribution of the CR4 and HHI indices using the various firm size distributions outlined above. The two tables present, for each of the concentration categories, the number of Canadian industries classified to the category, their average level of concentration, the number of firms, as well as the proportion of the sector value added accounted for by such industries. The tables refer to 140 4-digit manufacturing industries.[11] Those of a miscellaneous and heterogeneous nature have been excluded.[12] Table 1 also contains a hitherto undefined measure of concentration that makes only a partial adjustment for imports, since it does not consider the extent to which domestic producers are also importers: ClCR4 = PPCR4/(1+IMP/SHIP) where PPCR4 is as defined above, IMP is total imports into the industry and SHIP is the total shipments of the products primary to the industry, where the plants secondary output is allocated to its primary industry. CICR4 is similar to the concentration ratio used by Marfels (1979) for Canada, Utton (1982) and U.K., Interdepartmental Group on Competition Policy (1978) for the U.K. and Weiss and Pascoe (1982) for the U.S. These sources apparently made this "first-order" adjustment for imports because they did not have information to link importers with domestic manufacturers.[13]

Tables 1 and 2 both suggest that the conventionally calculated census measures of concentration (UCR4 and UHHI) substantially overstate the true degree of industry concentration (SICR4 and SIHHI). On average the four-firm concentration ratio falls by 10 percentage points; the Hirschman-Herfindahl index by 0.04 points. In both instances the typical industry can be characterized as more competitive: for the CR4, from being a moderately concentrated oligopoly to a slightly concentrated (or low grade) oligopoly; while for the HHI, from a category where competitive concerns are likely to arise to one where markets are likely to perform quite well.

Moreover, there has been a dramatic reduction in the number of industries classified to the category that has been posited to result in a misallocation of resources (CR4 = 75 - 100; HHI = 0.1000 - 1.00). They decrease from 28 to 10 if SICR4 rather than UCR4 is used; and from 30 to 13 if SIHHI rather than UHHI is adopted. In addition their importance when measured in terms of value added also decrease -- from 22.4 to 9.0 per cent, using SICR4 rather than UCR4; and from 22.8 to 12.7 per cent using SIHHI rather than UHHI. Hence, one can infer that Canadian manufacturing industries are much more competitive than indicated by published census concentraiton ratios.

Tables 1 and 2 permit us to examine separately the influence of secondary output (PPCR4, PPHHI) and imports (SICR4, SIHHI) on the standard census measures of concentration (UCR4, UHHI). We would

expect, based on our earlier discussion, that the impact of allocating secondary output to its primary industry would be small relative to the impact of imports. This is the case: most of the 10 percentage point difference between UCR4 and SICR4 is due to the difference between PPCR4 and SICR4 not UCR4 and PPCR4. A similar inference can be drawn with respect to the corresponding HHI indexes.

Nevertheless, to draw the inference that secondary output does not matter anywhere would be misleading. The number of industries where serious resource allocation problems are likely to occur does drop, using PPCR4 rather than UCR4 (28 to 23) and using PPHHI rather than UHHI (30 to 26). Moreover, examination of the 140 industries reveals 10 instances where the difference between UCR4 and PPCR4 was 10 percentage points or more, with UCR4 > PPCR4 in eight of the instances.[14] The reallocation of secondary output had a particularly marked effect on two industries: For industry A, which had UCR4 = 36.2 and PPCR4 = 82.9, HHI = 0.05, and PPHHI = 0.29, and for industry B for which the corresponding ratios were 66.5, 32.8, 0.15 and 0.04. In the former case, industry shipments (the denominator of the CR4) increased substantially; in the latter case, shipments fell precipitously. In both cases the misclassification occasioned by the omission of secondary output appears to be particularly important for the leading firms in comparison to the fringe. Hence, although on average, most of difference between UCR4 and SICR4 (as well as UHHI and SIHHI) is

accounted for by imports, reallocation of secondary output has a pronounced effect on a small number of industries.[15]

CICR4 is an approximation to SICR4 used by previous scholars because they lacked data relating importers to domestic firm operations. We know that CICR4 < SICR4, equality being obtained when imports are zero or the ratio of imports to domestic production is a constant for all firms. The maximum discrepancy occurs when the import propensity of the leading four domestic firms is such that they do all of the importation. Table 1 shows that the difference between CICR4 and SICR4 is only 4 percentage points, with CICR4 consistently classifying too few industries to concentration categories 25-100 and too many to category 0-24.99. If all imports had been conducted by the leading four domestic firms then SICR4 would be on average 60.2. Thus while, by definition CICR4 < SICR4, the actual difference is relatively minor compared to that which is possible under equally extreme assumptions. It would appear that most imports are made by firms outside the top four domestic firms and that the simple adjustment used in CICR4 is a good approximation to SICR4.

Utton (1982, Table 3, p. 487) estimated UCR5 and CICR5 for 121 products, for 1977, for the U.K., and found the mean levels of concentration were 64.8 and 54.8, respectively. The larger percentage point difference - 14.2 - recorded in Table 1 for Canada probably reflects the greater importance of imports in Canada: in 1977 imports accounted for 15.9 per cent of the U.K.

manufacturing sector sales (U.K., Interdepartmental Group on Competition Policy, 1978, Table 4, p. 11) compared to 27.2 per cent for Canada for 1979.

Table 3 permits us to show how many industries are shifted from one "concentration category" to another, once the appropriate concentration measure, SICR4 rather than UCR4, is used. Table 4 does the same for SIHHI as opposed to UHHI. Of the 56 industries using CR4, and the 42 using HHI, that change concentration category, most do so to a lower category. One industry increases concentration sufficiently to shift up two categories in both Tables 3 and 4: industry A for reasons discussed above. In Table 3 the remaining two industries which shift to a higher concentration category do so for different reasons: industry C because of imports, with UCR4 = 47.6 and SICR4 66.26; and PPCR4 = 45.1.[16] In this case either the leading domestic firms had high import propensities or one of the importers was sufficiently large to enter the leading four category. The other, industry D does so because of the reallocation of secondary output, since UCR4 = 39.1, PPCR4 = 50.1, SICR4 = 50.1.[17] Essentially there are no imports in this industry. Hence, Tables 3 and 4 confirm the results of Tables 1 and 2; making appropriate adjustments to published census concentration measures results in lower concentration estimates.

Table 5 permits identification of those 2-digit manufacturing industries where census concentration measures most overstate the

actual degree of concentration. For each major group the measure of concentration reported (HHI) is the weighted average of the constituent 4-digit industries, where the weights are industry total value added.[18] The industry groups where census concentration measures give the most misleading picture are Food and Beverages, Textiles, Machinery and Electrical Products, -- misleading in the sense that the difference between UHHI and SIHH is sufficient for the 2-digit industry to drop at least one of the concentration categories used in Table 2. In these three cases similar results are recorded for UCR4 and SICR4.

It is frequently found, using census CR4, (Marfels, 1977, pp. 166-169 and Canada, Department of Consumer and Corporate Affairs, 1971, pp. 47-53) that Canadian markets are more concentrated than their U.S. counterparts. Since trade is not as important for the U.S. as for Canada, the difference in concentration levels may not be as large after allowing for trade effects. For the U.S., imports accounted for 6.8 per cent of GNP in 1972 and 11.1 per cent in 1979. (Survey of Current Business, various issues); for Canada the corresponding percentages were 24.7 and 31.6, respectively, (Canadian Statistical Review, various issues). We present in Table 6, for 124 matched U.S. and Canadian industries, the unweighted averages of UCR4 for various years in the 1970s. In the early 1970s census concentration measures showed that, on average, Canadian manufacturing industries were more concentrated than those in the U.S. by close to 20 percentage points. Since the evidence suggests that for both the U.S.

(Shepherd, 1982, p. 625) and Canada (Canada, Statistics Canada, 1983, Table 1, p. 6) the mean level of UCR4 for manufactruing industries has remained unchanged during the 1970s, this percentage point difference probably persisted throughout the 1970s.

The issue which needs to be resolved is the degree to which the gap between UCR4 for Canada and the U.S. narrows if imports are taken into account for both countries. Table 6 shows that for Canada the decline in UCR4 is 10 percentage points in 1979 once this adjustment is made (SICR4). No corresponding measure is available for the U.S. Nevertheless, work by Weiss and Pascoe (1982) for 448 U.S. 4-digit industries for 1972 suggests that UCR4 would fall by approximately 3 percentage points when trade is taken into account.[19] Hence, we conclude, somewhat tentatively, that about seven of the 20 percentage point difference between measured U.S. and Canadian concentration ratios disappears if an adjustment for imports is made to both U.S. and Canadian published concentration ratios.

b) Some Extensions

The adjustments made in this paper may be criticised for failing to make any correction for exports. It may be argued that exports should be excluded from the denominator and numerator of an appropriately calculated measure of concentration. Implicit in this position is that measures of concentration should be defined

over a particular market -- Canada, the U.S., U.K. -- and in this context exports are not relevant. However, it could be argued that exports are an actual as well as potential source of supply that can be easily diverted to the domestic market to forestall a new entrant or to meet an increase in demand. If foreclosure of markets is regarded as an important phenomenon, exports should not be excluded in calculations of concentration measures. Nevertheless, since it has been conventional in attempting to take into account the impact of trade to adjust measures of concentration for both imports and exports, we follow that convention here and then compare our findings with others.

In adjusting measures of concentration for exports we use CR4, since it is much easier to correct, given the available data, than HHI. Furthermore, previous work, which has attempted to adjust measures of concentration for trade, has used the CR4 not the HHI. The CR4 measures adjusted for imports, exports and secondary output are as follows:

$$CICR4E = [(CICR4 \cdot SHIPIMP) - (PPCR4 \cdot XT)]/(SHIPIMP-XT);$$

$$SICR4E = [(SICR4 \cdot SHIPIMP) - (PPCR4 \cdot XT)]/(SHIPIMP-XT);$$

where XT is exports, SHIPIMP is total industry shipments plus imports and the other terms are as defined above. UCR4 has been adjusted in a similar way to take trade into account for Canada by Marfels (1979), for the U.K. both by Utton (1982) and in a review of merger and monopoly policy by the U.K., Interdepartmental Group

on Competition Policy (1978) and for the U.S. by Weiss and Pascoe (1982). In all these instances it is assumed that a firm's propensity to export is the same irrespective of firm size.[20] If the leading firms export more than the industry average, then CICR4E and SICR4E will underestimate concentration. The converse applies if the leading firms in an industry export less, in relation to sales, than the average. The assumption that the leading firms export as much on the average is likely to be most appropriate in the highly concentrated industries, since it is these firms that account for most of industry shipments.

Adjusting CR4 for imports, exports and secondary output shows there is little or no difference between CICR4 and CICR4E (a maximum of 1.8 percentage points) or SICR4 and SICR4E (a maximum of 1.0 percentage point) respectively. The average level of SICR4E across the 140 4-digit manufacturing industries was 42.6, CICR4E 38.6. Essentially the same result obtains if we assume that the leading four firms export 1.5 times the industry average -- the mean level of CICR4E decreases from 38.6 to 37.9 while for SICR4E the corresponding decline is 42.6 to 42.2.[21] Hence we conclude that even if one made adjustments for exports as well as imports and secondary output none of the conclusions and inferences drawn above would materially be altered: imports is the driving force lowering estimates of concentration, not exports.[22]

It is difficult to compare the results recorded here with those estimated elsewhere for UCR4 and CICR4E because of differences in industry sample, the importance of international trade, the treatment of secondary output, and the time period. As a result these other studies estimate CICR4E* (defined below) which is exactly the same as CICR4E, except no account is taken of secondary output. Nevertheless, bearing these caveats in mind, such comparisons all lead to the same conclusion: published census concentration ratios substantially overstate the degree to which a small number of firms control output when international trade is important. Hence the differences between Canada and the U.K., on the one hand, and the U.S. on the other. Marfels (1979, Table 1, pp. 135-141) for 58 Canadian manufacturing industries for 1970 finds the mean level of UCR4 is 52.4, of CICR4E* 39.6; Utton (1982, Table 1, p. 484) for 31 U.K. products that the mean level of UCR5 is 61.4 and CICR5E*[23] is 48.2; and, finally, for 144 U.K. manufacturing industries for 1972 the Interdepartmental Group on Competition Policy (1978, Table 8, p. 58) found the following industry distribution by concentration class:

| CR5 | UCR5 | CICR5E* |
|---|---|---|
| 70 - 100 | 41 | 21 |
| 50 - 69 | 26 | 32 |
| 30 - 49 | 46 | 45 |
| 0 - 29 | 31 | 46 |
| Total | 144 | 144 |

As noted above adjusting U.S. concentration ratios for trade for 1972 dropped UCR4, on average, by three percentage points, from the mid to low 30's. However, it must be remembered that CICR4E and CICR4E* are underestimates of the degree of concentration because no account of imports is taken in the numerator of the concentration ratio. Nevertheless, the degree of underestimation would not appear to seriously undermine inferences drawn from CICR4E and/or CICR4E* concerning the impact of trade on concentration levels.[24]

An important issue which the discussion above did not address is whether the trend in concentration over time is increasing, decreasing or stationary. As noted above, trade has increased in significance during the 1970s so, other things equal, the divergence between corrected census measures should increase over time. Unfortunately, we do not have measures of PPCR4, CICR4E or SICR4E for years prior to 1979, only UCR4. Nevertheless we can estimate,

$$CICR4E^{*} = [(UCR4.SHIP^{*}) - (UCR4.XT)]/(SHIP^{*}-XT+IMP),$$

where SHIP* is industry shipments, with secondary output allocated to the primary industry of the plant and the other terms are as defined as above. Hence the major difference between CICR4E and CICR4E* concerns the lack of data on the appropriate allocation of secondary output.

Table 7 presents the mean level of UCR4 and CICR4E* for 142 4-digit Canadian manufacturing industries for 1970, 1975 and 1979 as well as the number of industries in the highly concentrated oligopoly category. On average, census concentration ratios showed little change during the 1970s, with a 1 percentage point decline.25 However, adjusting the census concentration ratio for imports and exports shows a decline in the concentration measure during the 1970s -- 4.3 percentage points. The difference produced by the two approaches is much more dramatic when attention is focused on the number of industries where competition and resource allocation problems are likely to arise. For the trade adjustment measure of concentration such instances more than halve, while for census based measures the drop is much less. Hence, Canadian manufacturing industries would appear to be getting more competitive over time than indicated by official publications. This result is consistent with the work of Marfels (1979, p. 134) for Canada over the period 1965-1970, and Utton (1982, Table 3, p. 487) for the U.K. over the period 1958-1977.26

Our results can also be used to show that correcting standard measures of concentration has different effects where an industry is regional as opposed to national in nature. Trade is likely to be less important for industries which are regional than those which are national and therefore the corrections will probably affect national industries more. This prediction is borne out by the data in Table 8. The ratio of the mean level of UCR4 to that of SICR4 is much higher for national industries (1.26) than regional industries (1.13). This is also the cases for the HHI index. Hence, it would appear that, foreign trade has a much greater impact on national compared to regional industries. Moreover, when a rough correction is made for the deficiency of the national concentration figure for regional industries, national industries would appear to be less concentrated than regional industries,27 once these trade effects are considered.

c) Concentration, Imports and Price/Cost Margins: A Re-examination

Recently considerable effort has been devoted to specifying how imports should be included in the profit, cost mark-up equations to capture its effect as a source of competitive discipline (Caves, 1983). The problem arises basically because imports may or may not make up a competitive fringe. First, domestic firms may do most of the importing. Or as Geroski and Jacquemin (1981) have pointed out, foreign firms may dominate the domestic market.

The problem arises mainly because of our inability to quantify the structure of the domestic market when imports are considered. Our previously defined concentration measures overcome this problem -- though admittedly they give equal weight to structural problems arising from concentration either by domestic producers or foreign importers. But at least, our measures are in the spirit of the established literature. We therefore decided to estimate the traditional performance relationship for Canada using adjusted and unadjusted measures of concentration.

The structure-performance equations for Canada have been relatively unsuccessful in separating out the influence of domestic structure and foreign competition via trade flows. We discuss these previous findings of Caves et al (1980), Jones et al (1973, 1977), McFetridge (1973) and Sullivan (1983) further below. Hopefully, using the correct specification of the concentration variable will allow us to ascertain the effect of structure on performance.

Before we examine the impact of using unadjusted as opposed to adjusted concentration measures, it is useful to see how closely correlated they are with each other. Table 9 shows that for CR4 and HHI such correlations are typically fairly high, although clearly less than unity. This is particularly the case between UCR4 and PPCR4, SICR4 and CICR4 as well as UHHI and PPHHI. Correlations are lowest between the published census measures of concentration and those same measures corrected for imports and

secondary output -- 0.741 for CR4 and 0.830 for HHI. Hence, it might be inferred that whether concentration measures are unadjusted or adjusted is largely irrelevant for studies of the determinants of price/cost margins. However, such a finding would be erroneous.

Previous studies of the determinants of Canadian inter-industry performance have used a set of variables relating to entry barriers, incentives to enter and trade influences. In this paper we make use of the following standard set of variables. Except for GROWTH and ADVDM the variables all pertained to 1979.

| | |
|---|---|
| PCOSTM | total value added less value of wages and salaries all divided by total value of shipments (i.e., industry sales); |
| CAPVS (+) | end year gross capital stock divided by total value of shipments; |
| SCALE (+) | the average size of the largest plants accounting for 50 per cent of industry size divided by total value of shipments; |
| IMPT (-) | imports as a proportion of total value of shipments; |
| EXP (-) | exports as a proportion of total value of shipments; |
| ADVDM (+) | advertising as a proportion of total value of shipments for consumer non-durable industries, 0 elsewhere. (1977 data was used to approximate 1979); |
| GROWTH (+) | slope from the regression of log of total value of industry shipments (expressed in constant dollars), in time, 1970-1979; |
| REG (+) | a regional dummy variable, taking the value 1 if the industry is regional, 0 otherwise; |

CON (+) a census measure of concentration, such as UCR4 or UHHI.

where the expected signs of the variables are presented in parenthesis. In all instances these accord with earlier work (e.g., Jones, et al, 1973, 1977) and need not detain us further.

The typical price/cost margin study estimates a regression equation of the form:

(1) PCOSTM = $f_1$ (CAPVS, SCALE, EXP, ADVDM, GROWTH, REG, IMPT, CON).

Where a measure of concentration that corrects for imports is used, we exclude imports (IMPT).

Tables 10 (using CR4 as the measure of concentration) and 11 (using HHI as the measure of concentration) present OLS estimates of equation 1 using the 140-digit Canadian manufacturing industry sample introduced earlier. All the variables defined above are drawn from a specially created database at Statistics Canada. Econometric analysis utilizing the agency's data was carried out at Statistics Canada and the confidentiality provisions of the Statistics Act were respected concerning publication of results. Full details of the database and further elaboration on the definition of the variables used in Tables 10 and 11 may be found in Baldwin and Gorecki (1983) and sources cited therein.

In equation 1 of Table 10, which is similar to that estimated in earlier papers, GROWTH, CAPVS, ADVDM and EXP are all correctly signed and, with the exception of GROWTH, all significant at 0.10 or higher. In contrast, SCALE, IMPT, REG and UCR4 are all incorrectly signed and in the case of IMPT significant at 0.05, REG at 0.10.[28] Previous studies for Canada have explained the positive impact of IMPT on the grounds that as demand increases so does profitability and imports and/or that imports spur domestic firms to greater efficiency and rationalization thus raising profitability.[29] The lack of significance of SCALE is also consistent with earlier studies, perhaps reflecting collinearity with UCR4 (simple correlation 0.748).[30] Finally, the lack of significance of concentration is consistent with some earlier work.[31] Nevertheless our results do not exactly parallel earlier work, which is not surprising given the difference in time period (1960's vs 1979), of a larger sample of industries used here, and of access to more complete data.

In Table 10 equations 2 to 3b attempt to see whether using one of the corrected concentration ratios produces a different set of regression results. Equation 2 shows that the adjustment of CR4 for secondary output makes little difference: hardly a surprising result given the very high correlation between UCR4 and PPCR4 (0.961). However, some differences do occur when CR4 takes into account both imports and secondary output (equations 3a and 3b). SCALE now has the correct sign although it is not significant. In part this probably reflects the much lower collinearity between

SICR4 and SCALE (0.389) or SICR4 and SCALE (0.525). However, concentration does not take on the predicted positive sign. Instead, concentration is significantly negatively associated with performance. It would appear that the addition of imports to denominator of CICR4 and SICR4, irrespective of whether the numerator changes or not, is the driving force behind this negative impact. Reference to Table 11 suggests similar results if a different measure of concentration, the HHI, is used.

The results suggest either that structure has little positive impact upon performance or that the effect is considerably more complicated than is posited by a model which treats domestic production and imports as perfect substitutes. We tend toward the latter interpretation. Imports may consist of differentiated products satisfying demands which, for whatever reason, Canadian produced goods do not. Alternatively, imports by foreign firms with the implication of transfer pricing and intra-firm trade may have a different impact than arms length imports by a Canadian manufacturer. Finally, the leading producers in SICR4 may not be the same as UCR4: indeed the latter may form a fringe in an oligopolistic industry dominated by importers (and vice versa). These possibilities just scratch the surface, but do suggest that much more thought is required into modelling these relationships. While others have made some initial steps in this direction,[32] it is beyond the scope of this paper to resolve this problem for Canadian industry studies.

## IV Conclusion

International trade has increased considerably during the 1970's, as both exports and imports have risen in importance in relation to the size of domestic markets, even in such countries as the U.S. Hence, it would appear that it is increasingly inappropriate to measure concentration as though the economy were closed. This paper has shown that for Canada for 1979, measured or published concentration statistics, substantially underestimate the degree of concentration, once account of trade and secondary output is taken. Furthermore during the 1970's while published or census concentration ratios remained roughly unchanged overall, when account of trade is taken a noticeable decline takes place. Hence, other things equal, Canadian industry would appear to be more competitive because of increased trade flows in the 1970s.

Table 1

Unadjusted or Census Four-Firm Concentration Ratios Subject to Various "Corrections" for 140 Canadian 4-Digit Manufacturing Industries: 1979

| Concentration Ratio Categories | UCR4 | | | | PPCR4 | | | | CICR4 | | | | SICR4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Industry Count[a] | Concentration Level[b] | Share[c] | Firm Count[d] | Industry Count[a] | Concentration Level[b] | Share[c] | Firm Count[d] | Industry Count[a] | Concentration Level[b] | Share[c] | Firm Count[d] | Industry Count[a] | Concentration Level[b] | Share[c] | Firm Count[d] |
| 0 - 24.99 | 17 | 16.1 | 16.1 | 618 | 18 | 16.0 | 16.3 | 633 | 41 | 17.1 | 27.8 | 2219 | 25 | 16.7 | 19.3 | 2349 |
| 25 - 49.999 | 50 | 38.7 | 41.8 | 201 | 57 | 38.0 | 47.4 | 228 | 58 | 34.5 | 43.7 | 1378 | 69 | 35.4 | 45.1 | 1456 |
| 50 - 74.999 | 45 | 61.8 | 19.7 | 65 | 42 | 62.8 | 21.0 | 55 | 34 | 60.5 | 24.5 | 654 | 36 | 62.2 | 26.5 | 890 |
| 75 - 100 | 28 | 85.0 | 22.4 | 19 | 23 | 84.0 | 15.3 | 43 | 7 | 89.2 | 4.0 | 121 | 10 | 87.0 | 9.0 | 273 |
| All Industries | 140 | 52.6 | 100 | 171 | 140 | 50.2 | 100 | 198 | 140 | 38.4 | 100 | 1386 | 140 | 42.7 | 100 | 1386 |

a The number of industries classified to each concentration ratio category using the given index of concentration (UCR4, PPCR4, etc.)

b Average level of the given concentration index for industries in the concentration ratio category.

c The share of value added of the 140 manufacturing industries accounted for by industries classified to each concentration ratio category. Value added is based upon census value added.

d The average number of firms (i.e., unconsolidated enterprises) per industry for the industries classified to each concentration ratio category.

Source Statistics Canada. Special Tabulations.

Table 2

The Unadjusted or Census Hirschman-Herfindahl Concentration Index Subject to Various "Corrections" for 140 Canadian 4-Digit Manufacturing Industries: 1979

| Hirschman - Herfindahl Index (HHI) Categories | UHHI | | | | PPHHI | | | | SIHHI | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Industry Count[a] | Concentration Level[b] | Share[c] | Firm Count[d] | Industry Count[a] | Concentration Level[b] | Share[c] | Firm Count[d] | Industry Count[a] | Concentration Level[b] | Share[c] | Firm Count[d] |
| 0.000 - 0.0999 | 71 | 0.050 | 55.9 | 289 | 75 | 0.048 | 60.3 | 316 | 97 | 0.042 | 64.8 | 1645 |
| 0.1000 - 0.1799 | 39 | 0.141 | 21.3 | 71 | 39 | 0.136 | 21.3 | 72 | 30 | 0.134 | 22.5 | 844 |
| 0.1800 - 1.0000 | 30 | 0.258 | 22.8 | 24 | 26 | 0.261 | 18.3 | 47 | 13 | 0.262 | 12.7 | 610 |
| All Industries | 140 | 0.120 | 100 | 171 | 140 | 0.112 | 100 | 198 | 140 | 0.082 | 100 | 1386 |

a The number of industries classified to each concentration category using the given index of concentration (UHHI, PPHHI, etc.)

b Average level of the given concentration index for industries in the given category.

c The share of value added of the 140 manufacturing industries accounted for by industries classified to each concentration category. Value added is based upon census value added.

d The average number of firms (i.e., unconsolidated enterprises) per industry for the industries classified to each concentration ratio category.

Source Statistics Canada. Special Tabulations.

Table 3

Matrix of Relationship Between UCR4 and SICR4 for 140 Canadian 4-Digit Manufacturing Industries: 1979

| UCR4 \ SICR4 | 0 - 24.99 | 25 - 49.9 | 50 - 74.9 | 75 - 100 |
|---|---|---|---|---|
| 0 - 24.99 | 17 | 0 | 0 | 0 |
| 25 - 49.999 | 7 | 40 | 2 | 1 |
| 50 - 74.999 | 1 | 26 | 18 | 0 |
| 75 - 100 | 0 | 3 | 16 | 9 |

Note See text for definitions of UCR4 and SICR4

Source Statistics Canada. Special Tabulations.

Table 4

Matrix of Relationship Between UHHI and SIHHI for 140 Canadian 4-Digit Manufacturing Industries: 1979

| UHHI \ SIHHI | 0.000-0.0999 | 0.1000-0.1799 | 0.1800-1.0000 |
|---|---|---|---|
| 0.000-0.0999 | 70 | 0 | 1 |
| 0.1000-0.1799 | 23 | 16 | 0 |
| 0.1800-1.0000 | 4 | 14 | 12 |

Note See text for definitions of UHHI and SIHHI

Source Statistics Canada. Special Tabulations.

Table 5

Census Measures of the Hirschman-Herfindahl Index Subject to Various "Corrections" for 140 Canadian 4-Digit Manufacturing Industries, Organized by Major Manufacturing Industry Group,[a] Canada, 1979

| Major Group[b] Number of Constituent 4-Digit Industries | Title | The HHI Index UHHI | PPHHI | SIHHI |
|---|---|---|---|---|
| | | Weighted Averages at Major Group Level | | |
| 17 | Food and Beverages | 0.109 | 0.103 | 0.094 |
| 2 | Tobacco Products | 0.328 | 0.327 | 0.320 |
| 4 | Leather | 0.053 | 0.049 | 0.026 |
| 13 | Textiles | 0.199 | 0.190 | 0.120 |
| 2 | Knitting mills | 0.020 | 0.014 | 0.011 |
| 9 | Clothing | 0.021 | 0.021 | 0.017 |
| 9 | Wood | 0.033 | 0.034 | 0.031 |
| 3 | Furniture and fixtures | 0.018 | 0.016 | 0.014 |
| 5 | Paper and allied products | 0.052 | 0.051 | 0.049 |
| 4 | Printing and publishing | 0.042 | 0.045 | 0.031 |
| 6 | Primary metals | 0.209 | 0.191 | 0.142 |
| 9 | Metal fabricating | 0.051 | 0.057 | 0.049 |
| 3 | Machinery | 0.182 | 0.169 | 0.083 |
| 9 | Transportation equipment | 0.198 | 0.194 | 0.195 |
| 8 | Electrical products | 0.138 | 0.124 | 0.075 |
| 12 | Nonmetallic mineral products | 0.176 | 0.155 | 0.125 |
| 2 | Petroleum and coal products | 0.126 | 0.130 | 0.127 |
| 8 | Chemicals and chemical products | 0.091 | 0.066 | 0.052 |
| 15 | Miscellaneous manufacturing | 0.110 | 0.096 | 0.040 |
| 140 | All Industries | 0.115 | 0.109 | 0.091 |

a For each major group the relevant variable is the weighted average for the 4-digit industries into which the group is divided. The weights used are the industries' total value added.

b Also referred to as a 2-digit industry

Source Statistics Canada. Special Tabulations.

Table 6

U.S. and Canadian Concentration Ratios for 124 Canadian 4-Digit Manufacturing Industries[a] in the 1970s

| Country / Concentration Index | U.S. | Canada | |
|---|---|---|---|
| | (average levels of concentration) | | |
| | 1972 | 1970 | 1979 |
| UCR4 | 36.9 | 56.3 | 54.4 |
| SICR4 | - | - | 44.0 |

a Full details of the sample may be found in Baldwin and Gorecki (1983).

Note See text for definitions of UCR4 and SICR4

Source Statistics Canada. Special Tabulations.

Table 7

Trends in Concentration for 142[a] Canadian 4-Digit Manufacturing Industries: 1970, 1975 and 1979

| Concentration Measure[b] | Year 1970 | 1975 | 1979 |
|---|---|---|---|
| | | Mean Level | |
| UCR4 | 53.8 | 53.4 | 52.8 |
| CICR4E* | 43.2 | 40.2 | 38.9 |
| | | Number of Industries | |
| UCR4 > 75.0 | 35 | 29 | 29 |
| CICR4E* > 75.0 | 13 | 8 | 6 |

a See footnote 11 for an explanation of the use of 142 industries rather than 140.

b For 1970 for CICR4E*, XT and IMP are available for 1971, not 1970. Using a Gross Output Price Index these 1971 dollars are expressed in 1970 dollars.

Note See text for definition of measures of concentration.

Source Statistics Canada. Special Tabulations.

Table 8

Unadjusted or Census Measures Subject to Various "Corrections" for 140 Canadian 4-Digit Manufacturing Industries: Regional vs National, 1979

| Sample of Industries | Concentration Ratio: Mean Levels | | | |
|---|---|---|---|---|
| | UCR4 | PPCR4 | CICR4 | SICR4 |
| Regional[a] | 42.5 | 41.2 | 36.7 | 37.6 |
| National[b] | 56.4 | 53.5 | 39.1 | 44.6 |
| All[c] | 52.6 | 50.2 | 38.4 | 42.7 |
| | Hirshman-Herfindahl Index: Mean Levels | | | |
| | UHH | PPHHI | - | SIHHI |
| Regional[a] | 0.079 | 0.072 | - | 0.062 |
| National[b] | 0.135 | 0.127 | - | 0.090 |
| All[c] | 0.120 | 0.112 | - | 0.082 |

a 38 regional industries. Based on Canada. Department of Consumer and Corporate Affairs (1971).

b 102 national industries. Based on Canada. Department of Consumer and Corporate Affairs (1971).

b 140 industries.

Note See text for definitions of measures of concentration.

Source Statistics Canada. Special Tabulations.

Table 9

Correlation Matrix for Various Measures of Concentration,
Across 140 Canadian 4-Digit Manufacturing Industries, 1979

| | UCR4 | PPCR4 | SICR4 | CICR4 | UHHI | PPHHI | SIHHI |
|---|---|---|---|---|---|---|---|
| UCR4 | 1.000 | 0.961 | 0.855 | 0.741 | 0.877 | 0.836 | 0.754 |
| PPCR4 | - | 1.000 | 0.914 | 0.808 | 0.844 | 0.876 | 0.823 |
| SICR4 | - | - | 1.000 | 0.931 | 0.754 | 0.787 | 0.923 |
| CICR4 | - | - | - | 1.000 | 0.653 | 0.685 | 0.864 |
| UHHI | - | - | - | - | 1.000 | 0.951 | 0.830 |
| PPHHI | - | - | - | - | - | 1.000 | 0.875 |
| SIHHI | - | - | - | - | - | - | 1.000 |

Note See text for definition of measures of concentration.

Source Statistics Canada. Special Tabulations.

Table 10

The Determinants of Price Cost Margins in 140 Canadian 4-Digit Manufacturing Industries, Using Different Concentration Ratios, 1979

| EQ# | CONSTANT | CAPVS | SCALE | ADVDM | IMPT | EXP | GROWTH | REG | Concentration Measures UCR4 | PPCR4 | CICIR4 | SICR4 | $R^2$ | F-RATIO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Regression Coefficents and Values[a] | | | | | | | | | |
| 1 | 0.199* (11.58) | 0.051* (4.61) | -0.009 (-0.06) | 2.521* (6.89) | 0.025** (2.11) | -0.063** (-2.26) | 0.001 (0.78) | -0.024*** (-1.67) | -0.0003 (-0.84) | - | - | - | 0.3198 | 9.17* |
| 2 | 0.199* (12.03) | 0.051* (4.66) | -0.010 (-0.07) | 2.511* (6.91) | 0.024** (2.11) | -0.063** (-2.26) | 0.001 (0.80) | -0.024*** (-1.67) | - | 0.0004 (-0.97) | - | - | 0.3210 | 9.22* |
| 3a | 0.212* (14.25) | 0.056* (5.17) | 0.080 (0.74) | 2.580* (7.12) | - | -0.056** (-2.10) | 0.002 (0.93) | -0.025*** (-1.79) | - | - | -0.0009* (-2.76) | - | 0.3356 | 11.03* |
| 3b | 0.211* (13.90) | 0.054* (4.97) | 0.100 (0.87) | 2.545* (6.99) | - | -0.046** (-1.71) | 0.002 (0.99) | -0.026** (-1.86) | - | - | - | -0.0008** (-2.37) | 0.3258 | 10.60* |

a t-values in parenthesis; $R^2$ tested by F test; all t-tests are one tailed except IMPT, REG, UCR4, PPCR4, CICIR4 and SICR4

* Significant at .01 level.

** Significant at .05 level.

*** Significant at .10 level.

Source Statistics Canada. Special Tabulations.

Table 11

The Determinants of Price Cost Margins in 140 Canadian 4-Digit Manufacturing Industries, Using the Hirschman-Herfindahl Index, 1979

| EQ | CONSTANT | CAPVS | SCALE | ADVDM | IMPT | EXP | GROWTH | REG | Concentration Measures UHHI | Concentration Measures PPHHI | Concentration Measures SIHHI | $\bar{R}^2$ | F-RATIO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Regression Coefficents and Values[a] | | | | | | | | |
| 1 | 0.192* (13.41) | 0.049* (4.64) | -0.051 (-0.040) | 2.499* (6.87) | 0.025** (2.13) | -0.063** (-2.26) | 0.001 (0.73) | -0.024*** (-1.67) | -0.0053 (-0.67) | - | - | 0.3185 | 9.12* |
| 2 | 0.191* (13.37) | 0.048* (4.59) | -0.072 (-0.59) | 2.488* (6.84) | 0.025** (2.15) | -0.064** (-2.26) | 0.001 (0.71) | -0.024 (-1.66) | - | -0.035 (-0.45) | - | 0.3172 | 9.07* |
| 3 | 0.198* (14.10) | 0.050* (4.70) | 0.046 (0.42) | 2.500* (6.83) | - | -0.047** (-1.73) | 0.001 (0.83) | -0.027*** (-1.92) | - | - | -0.166*** (-1.80) | 0.3141 | 10.09* |

a t-values in parenthesis; $\bar{R}^2$ tested by F test; all t-tests are one tailed except IMPT, REG, UHHI, PPHHI, and SIHHI.

* Significant at .01 level.

** Significant at .05 level.

*** Significant at .10 level.

Source Statistics Canada. Special Tabulations.

Notes

1 For Canada see Caves et al (1980) and Jones et al (1973, 1977) who use the concentration ratio and McFetridge (1973) who uses the Hirschman-Herfindahl index.

2 For Canada, see proposed legislation as discussed in Reuber and Wilson (1979). This would allow the four largest firms in an industry to control 80 per cent of the industry (20 per cent each) before the government would be able to challenge a merger by any of the four leading firms.

3 For the U.S., see the guidelines issued by the U.S. Department of Justice (1982) where the Hirschman-Herfindahl index is used as the measure of concentration. These guidelines are discussed further below.

4 Both of these limitations are mentioned in the latest set of concentration statistics published for Canada. See Canada, Statistics Canada (1983, p. 27)

5 For further discussion see Curry and George (1983, pp. 204-207). On the relationship between measures of concentration and measures of industry performance see Cowling and Waterson (1976) and Dansby and Willig (1979).

6 For further details see, for example, Conklin and Goldstein (1955). For an example using Canadian data for the pulp and paper industry which uses alternate market definitions, see Gorecki (1971).

7 Sales, or shipments are the only feasible size dimension that can be used where correcting the size distribution for secondary output and imports. (For a discussion of the appropriate size dimension see Curry and George (1983, p. 213). Curry and George (1983) do not consider the best size dimension in the context of secondary output and imports.

8 Several 4-digit industries were of a service nature and had no primary products. These were excluded from the 167 industry sample to derive the 90 per cent figure. These results did not vary by more than a percentage point if "miscellaneous" industries were excluded or a weighted primary product specialization ratio average, using industry value added as weights, was estimated. Earlier work by one of the authors also found, at the 3-digit SIC level for the Canadian food sector, similar results. (Gorecki, 1980)

9 See Canada, Department of Consumer and Corporate Affairs (1971, p.21) which follows Bain. Others have used the concentration ratio as an indicator of the degree of competition, but frequently, with additional criteria, and not necessarily the same categories as used here. (e.g., Shepherd, 1982).

10 See U.S., Department of Justice (1982, p. 647).

11 Although published concentration ratios are available for 167 manufacturing 4-digit industries, the data source linking imports to domestic firm operations (Canada, Statistics Canada, 1981), in a number of instances, combined several 4-digit industries into a single 3-digit industry. This reduced our data set to 163 industries. (In Table 7, when these combinations are not made, the sample size increases to 142 industries.)

12 Using UCR4, the 23 miscellaneous industries were concentrated in the 0 - 24.99 and 25 - 49.99 categories (8 and 11 industries respectively) rather than the higher concentration categories (3 industries in 50 - 74.99 and 1 in 75 - 100).

13 All of the sources mentioned above present measures of concentration adjusted for both imports and exports. We discuss this further below in III (b). Only Utton (1982) adjusts for imports in the same manner as CICR4 and presents the results. Note that most of the sources do not adjust for secondary output. Hence, their trade adjusted measure is CICR4E* rather than CICR4E. Both of these measures are defined further below.

14 A casual examination of the underlying data revealed no particular pattern to explain why UCR4 and PPCR4 differed. In some instances the denominator of UCR4 exceeded that of PPCR4 and concentration declined; but the converse also occurred.

15 This result suggests the census industry definitions have been successful in minimizing the extent to which secondary output improperly distorts reported statistics.

16 The corresponding HHI indices were as follows: 0.10688; 0.17083 and 0.09039.

17 The corresponding HHI results were as follows: 0.05435; 0.08297; and 0.08297.

18 Since problems of confidentiality appeared to plague presentation of CR4, even at the 2-digit level, these are not included in Table 5, although reference to the results concerning use of CR4 is made. (See Canada. Statistics Canada, 1983, Table III p.9.)

19 Weiss and Pascoe (1982) make a number of adjustments (trade and market definitions) to UCR4 for 448 4-digit U.S. manufacturing industries for 1972. The trade adjustment adds industry imports and deducts industry exports (XT) from the denominator of UCR4 and subtracts UCR4.XT from the numerator. (This adjustment is defined in the text below as CICR4E*.) The complete set of adjustments are made by Weiss and Pascoe to UCR4 in such a way that those concerned with trade are introduced only after several market definition adjustments have first been conducted. Hence, it is difficult to compare Weiss and Pascoe's (1982) results with those

presented here. Nevertheless, for 268 of the 448 industries no adjustments to UCR4 were made for market definition reasons; and for the remaining 180 industries some market definition adjustments were made. Their results can be tabulated as follows:

| Industry Sample | UCR4 | UCR4 Adjusted For: Market Definitions | UCR4 Adjusted For: Market Definitions and Trade |
|---|---|---|---|
| | Mean Industry Level | | |
| 448 | 36.4 | 40.9 | 38.0 |
| 268 | 37.5 | 37.5 | 34.6 |
| 180 | 34.7 | 46.1 | 43.0 |

The sample mean of UCR4 for the 448 industries is quite similar to that presented in Table 6 for only 124 industries. The impact of the trade adjustment is about 3 percentage points, no matter which of the samples is selected. Since we show below that adjustments for exports have essentially no impact on UCR4, this percentage point decline can be attributed almost wholly to imports.

20 There is a slight difference between the measures of previous researchers and our own since others have used UCR4 rather than PPCR4 in estimating the amount of exports to be deducted from the numerator of the concentration ratio.

21 Utton (1982, p. 482) found, admittedly for the U.K., that "In 27 of the 32 products the largest five producers were responsible for a higher proportion of exports than of sales and in some cases the difference was considerable." The use of a 1.5 assumption in estimating SICR4E and CICR4E should take care of this possibility. While such data is not readily accessible for Canada, the percentage of total exports accounted for by the leading four exporters (not producers) for 91 of the 140 industries in Table 3 has been made available to us. (We should like to thank H. Potter of the Manufacturing and Primary industries Division of Statistics Canada in this regard). Assuming that the leading for producers and exporters are indeed the same firms, then re-estimating SICR4E and CICR4E does not materally change results reported in the text: the mean level of SICR4E is now 43.4, of CICR4E, 38.8; and the maximum difference between SICR4 and SICR4E is now 2.5 percentage points rather than 1.0, while for CICR4E and CICR4 the corresponding percentage point differences are 2.5 and 1.8, respectively.

22 This finding agrees with Cowling (1978, p. 14).

23 Utton's (1982) measure of CICR5E takes into account the actual distribution of exports by firm, but puts all imports into the denominator of the concentration ratio. However, since imports are the driving force accounting for the fall in observed levels of concentration Utton's approximation to CICR5E is likely to be quite close.

24 Cowling (1978) criticised the Interdepartmental Group on Competition Policy (1978) for its treatment of imports: "The critical assumption here is that imports are not controlled in any way by the top five firms in the industry in question." (p. 14) and suggested that CICR5E could therefore "be very misleading" (p. 16). While this is theoretically correct, the evidence for Canada, where foreign trade and foreign ownership is more important than the U.K., suggests that for the U.K. CICR5E may not be grossly misleading with respect to the impact of trade on measured concentration.

25 This agrees with the weighted averages presented for the 1970s in Canada, Statistics Canada (1983, Table 1, p. 6).

26 In the case of the U.K., Utton (1982, Table 3, p. 487) shows that UCR5 for 121 products rose, on average, from 56.5 in 1958 to 64.8 in 1977, while for CICR5 the corresponding numbers were 52.3 and 54.8 respectively. Marfels (1979, p. 134) found the difference between UCR4 and CICR4E "is 10.8 percentage points for 1965, 12.0 for 1968 and 12.6 for 1970," but, as noted above, for a much smaller sample than used here. In his sample, concentration using uncorrected measures, remains unchanged from 1965 to 1970, but declines by about 2 percentage points between 1965 and 1970. This is just about half the decrease we report for the 1970s.

27 We have not corrected measures of regional concentration to reflect the fact that standard measures consider the market to be national and therefore underestimate concentration measures in regional industries. Canada, Department of Consumer and Corporate Affaires (1971, pp. 37-40) compared the weighted average regional concentration ratios to the national concentration ratios for 18 of 34 regional industries and found the average to increase by 12 percentage points. Extrapolating this to our sample reported in Table 8, after making corrections for trade effects, would make regional industries less concentrated than national industries -- rather than the reverse if this correction was made to the unadjusted concentration ratio (UCR4 in columm 1 of Table 8).

28 It could be argued that REG should be entered in an interaction term with the selected measure of concentration in each equation in Tables 10 and 11. Re-estimation with this interaction term replacing REG does not materially change the reported results concerning the impact of concentration on price/cost margins: although in Table 11 neither the interaction

term or the measure of concentration were ever significant at .10 or less, with both still negatively signed.

29 See Jones et al (1973, 1977) as well as Caves et al (1980, pp. 233-236) and the extension of Caves' 1967 results by Sullivan (1983) for 1970 and 1979..

30 See Jones et al (1973, 1977) Caves et al (1980) and McFetridge (1973). If SCALE is omitted from each equation in Tables 10 and 11 the sign and significance of the measure of concentration remains unchanged.

31 Jones et al (1973, 1977) for their all industry sample usually find UCR4 is insignificant; McFetridge (1973) using HHI finds a positive significant relationship; while Caves et al (1980, p. 235) finds a variant of UCR4 positive and significant. Note McFetridge (1973) does not use either import or export data in his regression analysis.

32 See, for example, Cowling (1978), Geroski and Jacquemin (1981), and references cited in the latter source.

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